Title: Exploring the Stock Market

Link to Outcomes:

- **Problem Solving** Students will model a real-world situation by using information and mathematical data on companies to build a stock portfolio.
- **Communication** Students will discuss stocks to be included in portfolio with other students. They will communicate their choices to a broker. They will present their choices and reasoning to the class. They will report their final results.
- **Reasoning** Students will research and analyze information and data about companies in order to select stocks for portfolio.
- **Connections** Students will use concepts in mathematics in a real-world modeling situation.
- **Functions** Students will use data to investigate functions.
- **Statistics** Students will analyze statistical data drawn from their modeling problem. They will construct and draw inferences from bar graphs which summarize data from a real-world situation.
- **Technology** Students will use the Internet to do research and communicate information. Students will use TI-82 graphics calculators to analyze data.
- **Cooperation** Students will work in groups of four to develop their portfolios and analyze the results of their investments.
- **Interdiscipline** Students will research information and write essays. A professional will expose them to the basics of investing in the stock market.

Brief Overview:

Real-world problem situations are becoming more important in the study of mathematics. Students gathering and analyzing data makes these real-world situations more relevant to their lives. This lesson allows students, working in teams of four, to develop stock portfolios and track performance over the course of several weeks. In the process, students will utilize both human and technological resources, including the TI-82 graphics calculator and the Internet. Students will have the ongoing task of preparing written support and documentation and compiling it into a research portfolio (hereafter referred to as their "project folder").

Grade/Level:

Grades 9-12: Algebra II or Math Analysis

Duration:

Three months or more on-going project.

Prerequisite Knowledge:

Basic knowledge of functions and function notation.

Objectives:

Students will:

- acquire a rudimentary understanding of the stock market and track stock performance.
- use the Internet both to access and to transmit information.
- apply their knowledge of functions and statistics to interpret and analyze a real-world problem.
- prepare a research report and an assessment document.
- learn to work cooperatively and to prepare a group report for class presentation.
- use their graphing calculators to input and to graph data for analysis.

Materials/Resources/Printed Materials:

- Computers with access to the Internet
- TI-81/TI-82 graphics calculators
- Stockbroker
- Newspapers, journals, and periodicals which contain market information
- Student worksheets
- Instructions/directives for students
- Rubric for evaluating project presentations

Development/Procedures:

WEEK 1: Visit from the Broker

A speaker from the financial community will introduce the students to the stock market. Most students will have had little, if any, exposure; few will even know what is a stock. The speaker will explain how the market functions, how students might approach the problem of building a stock portfolio, and how one reads the financial pages (stock quotes) and assesses a stock's performance.

Following the speaker's visit, students will complete a worksheet to assess their understanding of rudimentary market functions. (See Worksheet #1) This worksheet will be the first entry in student's project folder.

WEEKS 2 AND 3: Tracking a Stock/Analyzing Its Performance

Each student will select a single stock that piques his/her interest and will follow its performance for two weeks. Written record must be maintained of the stock's closing quote each day. At the end of two weeks, students will input this data in the graphing calculators and use graphical and statistical means to analyze the performance of the stock.

Students will prepare the following for their research folders:

- newspaper clippings of daily quotes for the stock, neatly presented on a single sheet of paper
- graph of data as shown on the calculators (hardcopy obtained via "Graph-Link" software)
- worksheet in which students analyze the stock's performance by interpreting its graph (See Worksheet #2).

WEEK 4: Becoming Internet Jockeys

Students will now be provided a hands-on introduction to the Internet, courtesy of a resident technological guru. With a lab of 15 Macintosh computers linked to the Internet via a modem pool, students will have easy access to this invaluable resource. Introduction will include exposure to the World Wide Web, Gopher, Usenet and FTP locations as well as instruction on the use of e-mail.

After two days, students will test their newly acquired knowledge of the Internet. They will search, via Gopher, for information about the nature and operations of the company they have tracked for the past two weeks. Using FTP (file transfer protocol), they will download selected information and include it in their project folders.

WEEK 5: Researching Stocks

At this point, students will form teams of four. Each within the team will select two stocks for potential inclusion in the team portfolio. In researching the companies, students must use the "computer superhighway" and at least two additional resources which may include, but are not limited to, financial papers (e.g., "The Wall Street Journal") and journals (e.g., "Money Magazine" or "Business Week").

Each student will include in the project folder a report which describes the companies selected and the rational for that selection. (See Instructions #1)

WEEK 6: Selecting the Portfolio

Teams confer and determine the final composition of their portfolios. Teams may select either one or both of the stocks of the individuals on their team; thus, the final portfolio may contain as few as four or as many as eight stocks.

The team will prepare one paper (to be included in each member's report folder), which justifies the composition of their portfolio.

WEEK 7: Divide Up That Money!

Each team will receive $20,000 to apportion among the stocks in its portfolio. The team must buy shares of each of the stocks listed in its portfolio; it may buy only in blocks of 100 shares. Any excess money must be invested in the bank at 3% compound interest. (Broker's fees are ignored for the purpose of simplification.)

Students, at this point, are to seek advice on the construction of their portfolio by querying, via e-mail, the financial consultant who spoke to them at the opening of school. In addition, they may wish to use "Usenet" (the bulletin board on the Internet) and see what they get for advice!

Teams will present their portfolio selection to the class. Visual aids are required (e.g., a team may choose to present a bar graph to illustrate allocation of funds).

WEEKS 8 THROUGH 11: The Portfolio Challenge!

Students are now ready to play "The Portfolio Challenge"!! Each business day, for a period of four weeks, students will record the current value of each stock in their portfolio. (See Worksheet #3) They can obtain the daily market quotes either through the Internet or by reading the financial pages of a newspaper. On Monday of each week, students will draw their team's "bar" on a bar graph of portfolio performance which is maintained for all teams in all the classes that are playing the Portfolio Challenge. (This bar graph will be maintained on a bulletin board at the end of the math hall.) At the end of the four-week period, the team whose portfolio has gained the most in value will win a prize (yet to be determined).

WEEK 12: Tying It All Together

For evaluation purposes, students must do all of the following:

- submit for inclusion in their report folder the final copy of the stock performance chart which they have maintained throughout the four-week playing period (Worksheet #3).

- present as a team to the class, an evaluation and analysis of its portfolio's performance (visual aids required) (See Rubric #1).

- complete a worksheet which ties together the study of the stock market with their study of functions (See Worksheet #4).

- write a paper evaluating the overall project (See Instructions #2).

THE FUTURE: Possible Project Extensions

- Students may elect to participate with the "big guys" in an ongoing portfolio game being played on the Internet.

- Students may choose a single stock in which to invest as a class, with each student contributing a couple of dollars in order to participate. Hopefully, our "broker-connection" will waive any fee. Students will have fun tracking the performance of their stock and deciding when they want to sell it!

- Students will do a similar unit exploring mutual funds. The broker will explain the difference between mutual funds and individual stocks, how to read mutual fund reports, and how to assess a fund's performance.

Evaluation:

Each student will prepare a project folder which will contain the following:

- Worksheets:
  - assess understanding of basic market functions
  - analyze a graph of a stock's behavior
  - track portfolio performance
  - analyze portfolio performance as a function of time

- Research on companies considered for inclusion in the portfolio

- Student writings:
  - justifications of stock selections
  - assessment of the project

At the close of the project, student teams will present class lectures concerning their portfolios and overall performance.

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WORKSHEET #1

What is Your Knowledge of the Stock Market?

1. What is a broker?

2. What is a stock?

3. What is a block of stock?

4. What is a portfolio?

5. What does it mean to diversify a portfolio?

6. In what publications can you find stock market prices (quotes)?

7. Where can you find information about companies on the stock market?

8. How do you buy or sell a stock?

9. What do the following mean?

   a. NASDAQ

   b. AMEX

   c. DOW

   d. NYSE

10. What is a mutual fund?

11. On the NYSE, a listing was:

52 Week						Sales				
Hi	Lo	Stock	Div	Yld	PE	100	High	Lo	Last	Chg

(Actual market entry from the paper to be pasted in this space)

A	B	C	D	E	F	G	H	I	J	K

Explain each column A through K in the space provided below:

A

B

C

D

E

F

G

H

I

J

K

12. Why would a company want to sell stock to the public?

13. Why is the stock market important?

WORKSHEET #2

Analysis of Your Stock's Data Points

** Tape your graph-link picture here **

1. What was the closing quote (price) of your stock on the first day?
2. What was the closing quote of your stock on the last day?
3. What was the change in price over this time period?
4. Did you make or lose money on your stock over this period? How much?
5. On how many days was the stock more than on the first day?
6. On how many days was the stock less than on the first day?
7. On what day did the stock make the greatest change?
8. What was this net change?
9. Calculate the percentage change in value .
10. Did the stock close at the same price on more than one day?
11. If yes, at what price(s) and on what dates.
12. Which price represents the mode?
13. What was the maximum quote?
14. What was the minimum quote?
15. Connect the data points for days 9 and 10. Is the slope of this line positive or negative?
16. What real-world meaning does this sign have?

17. What is the magnitude of the slope of this line?

18. Relative to the value of the stock, what real-world meaning does the slope have?

19. Which would be better financially, a slope of 2 or a slope of ½? Explain your answer.

20. What is the mean (average) value of the closing stock quotes over this time period?

INSTRUCTIONS #1

Directions for Research and Writing on Selected Company Stocks

1. You will write summaries on each of the two stocks you selected. The summaries will include the following background information:

   The name of the company
   The type of industry
   The size/revenue, number of employees, location, and other relevant data
   Current stock market price (include date of quote)
   Product(s) manufactured, service(s) provided, etc. depending on the industry

   In the body of your paper, discuss how and why you selected this particular stock.

2. You will use three sources to support your selection:

   Newspapers: "Wall Street Journal," "Barrons," "NY Times"
   Journals: "Money Magazine," "Business Week," "Fortune"
   Technology: Internet (You must use this as one of your sources)

3. The summaries for each stock should be at least one page in length or 250 words.

4. On a separate sheet, list sources for each company. Make sure to include:

   Name of source
   Title of article
   Date of article
   Page numbers of article

Worksheet #3
Portfolio Data Sheet
Exploring The Stock Market

Group: _____ Week Number ___

Name of Stocks	Quantity	Monday Date _____		Tuesday Date _____		Wednesday Date _____		Thursday Date _____		Friday Date _____	
		Closing Price	Value	Closing Price	Value	Closing Price	Value	Closing Price	Value	Closing Price	Value
Amount In Bank	--------										
Total Value of Portfolio											

WORKSHEET #4

Analyzing the Portfolio from a Functions Standpoint

Directions: Plot the data points which represent the value of your portfolio on each day throughout the four-week period. Connect the data points.

** Grid goes here **

1. Does your graph pass the “vertical line test?”
2. Does each "input" have a unique “output?”
3. Does this graph represent a function?
4. Explain your answer to the previous question in real-world terms.
5. a. What is the domain of this curve? (use interval notation)

   b. What real-life quantity is represented by the domain?
6. a. What is the range of this curve?

   b. What real-life quantity does the range represent?
7. As the curve is graphed above, would you describe it as continuous or discontinuous?
8. In the real-world context, explain whether you feel the curve is actually continuous or discontinuous and WHY.
9. a. At (date), what was the value of the portfolio?

   b. On what date(s) did the value of your portfolio exceed $20,000?

10. Complete the following:

    a. f(month/date/year) = b. f(month/date/year) = c. f(month/date/year) =

11. Find all values of x for which the given statement is true:

    a. $f(x) = 20{,}500$ b. $f(x) = 19{,}500$

    c. $f(x) = 16{,}000$ d. $f(x) = 22{,}000$

12. a. What is the maximum value attained by this curve?

    b. At what input value does the max occur?

    c. What does this mean in the real-world context depicted by the graph?

13. a. On what date did the portfolio reach its low?

    b. What was its low?

    c. Use function notation to state the fact represented by questions a and b.

14. a. What was the value of your portfolio at the beginning of this project?

    b. What was the value at the close?

    c. What was the net change? (indicate + or -)

    d. What was the percentage change?

15. During week 3, over what intervals was:

    a. the function increasing?

    b. the function decreasing?

RUBRIC FOR GRADING CLASS PRESENTATIONS

1. Every student on team presents

2. Professionalism of presenters

3. Use and quality of visual aids

4. Discussion of portfolio composition

5. Discussion of individual stock performance (which stocks performed well, which poorly)

6. Discussion of portfolio performance

STUDENT ASSESSMENT OF PROJECT AND INSTRUCTIONS FOR FINAL WRITING

This is an individual writing and should be at least one page or 250 words in length. Answer and include the following in the writing:

- What did you learn during the project?
- What did you find the most difficult or challenging aspect?
- What did you find the most enjoyable?
- Discuss the length/duration of the project.
- State positive and negative aspects of the project.
- What tasks or assignments can be improved and how can they be improved?
- Explain why this experience was (or was not) worthwhile for you.